Claims

1. An X-ray tube (10) in which an anode (20) and a cathode (30) are disposed opposite each other in a vacuumized inner space (40), electrons (e^-) being able to be produced at the cathode (30), being able to be accelerated to the anode (20) by means of impressible high voltage, and X rays (γ) being able to be produced at the anode (20) by means of the electrons (e^-), the X-ray tube (10) comprising a multiplicity of mutually complementary acceleration modules (41,...,45), each acceleration module (41,...,45) comprising at least one potential-carrying electrode (20/30/423/433/443), a first acceleration module (41) comprising the cathode (30) with electron extraction (e^-), and a second acceleration module (45) comprising the anode (20) with the X ray generation (γ),

wherein

the X-ray tube (10) comprises at least one further acceleration module (42,...,44) with a potential-carrying electrode (423/433/443), the acceleration module (42,...,44) for acceleration of electrons (e^-) being repeatedly connectible in series as often as desired, and the X-ray tube (10) being of modular construction.

2. The X-ray tube (10) according to claim 1, wherein the difference in potential between each two potential-carrying electrodes (20/30/423/433/443) of adjacent acceleration modules (41,...,45) is constant for all acceleration modules (41,...,45), the final energy of the accelerated electrons (e^-) being a whole-number multiple of the energy of an acceleration module (41,...,45).

3. The X-ray tube (10) according to one of the claims 1 or 2, wherein at least one of the acceleration modules (41,...,45) has a reclosable vacuum valve (531) and/or vacuum seals on one side or on two sides.

4. The X-ray tube (10) according to one of the claims 1 to 3, wherein

the acceleration modules (41,...,45) include a cylindrical ceramic insulator (53).

5. The X-ray tube (10) according to claim 4, wherein the insulating ceramic (53) has a high-ohmic interior coating.

6. The X-ray tube (10) according to one of the claims 4 or 5, wherein the ceramic insulator (53) comprises a ridged exterior structure.

7. The X-ray tube (10) according to one of the claims 1 to 6, wherein the anode (20) comprises a target for X-ray generation as well as an emission hole (201) for X-radiation.

8. The X-ray tube (10) according to one of the claims 1 to 6, wherein the anode (20) includes a transmission anode, the transmission anode closing off the vacuumized inner space (40) toward the outside.

9. The X-ray tube (10) according to one of the claims 1 to 7, wherein the electrodes (20/30/423/433/443) of the acceleration modules (41,...,45) include a shield (412,...,415) for suppression of the stray electron flow on the ceramic insulator (51).

10. The X-ray tube (10) according to claim 9, wherein at least one of the electrodes (423/433/443) and/or shields (412,...,415) comprises spherically or conically designed ends for reducing or minimizing the field peak at the respective electrode (423/433/443) and/or shield (412,...,415).

11. An irradiation system (60), wherein the irradiation system (60) comprises at least one X-ray tube (10) according to one of the claims 1 to 10 with a high voltage cascade (62) for voltage supply of the X-ray tube (10).

12. A method of production of an X-ray tube (10) according to one of the claims 1 to 10, wherein the X-ray tube (10) is produced in a one-step vacuum soldering process.

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Abstract

Modular X-ray tube (10) and method for the production of such an X-ray tube, in which an anode (20) and a cathode (30) are arranged in a vacuumized inner space (40) situated opposite each other, electrons (e^-) being produced at the cathode (30) and X-rays (γ) at the anode (20), the X-ray tube (10) comprising a multiplicity of acceleration modules (41,... ,45), complementing one another. Each of these acceleration module (41,... ,45) comprises at least one potential-carrying electrode (20/30/423/433/443), a first acceleration module (41) comprising the cathode (30) with electron extraction (e^-), and a second acceleration module (45) comprising the anode (20) with the X ray generation (γ). The X-ray tube (10) according to the invention comprises at least one further acceleration module (42,... ,44) with a potential-carrying electrode (423/433/443), the acceleration module (42,... ,44) for acceleration of electrons (e^-) being repeatedly connectible in series as often as desired, and the X-ray tube (10) being of modular construction.

(Figure 5)

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